

CS107-45

Refrigeration-Condensing-Units; Electric, Commercial

U. S. DEPARTMENT OF COMMERCE

JESSE H. JONES, Secretary

NATIONAL BUREAU OF STANDARDS

LYMAN V. BRIGGS, Director

COMMERCIAL
ELECTRIC-REFRIGERATION
CONDENSING UNITS
(SECOND EDITION)

COMMERCIAL STANDARD CS107-45

(Supersedes CS(E)107-43)

Effective date for new production six months after official announcement
of cessation of hostilities.



A RECORDED VOLUNTARY STANDARD
OF THE TRADE

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PROMULGATION

of

COMMERCIAL STANDARD CS107-45

for

COMMERCIAL ELECTRIC REFRIGERATION
CONDENSING UNITS

(Second Edition)

On June 23, 1942, at the instance of the Standard Refrigeration Compressor Association, a representative conference of manufacturers adjusted and adopted a recommended commercial standard for commercial electric-refrigeration condensing units, which was subsequently revised to suit composite comment resulting from its circulation on July 8, 1942, to manufacturers, distributors, installers, contractors, and users. The adjusted draft was accepted by the trade and promulgated as Commercial Electric-Refrigeration Condensing Units, Commercial Standard (Emergency CS(E)107-43).

On June 23, 1944, a revision submitted by the Standard Refrigeration Compressor Association, and approved by the standing committee, was circulated for acceptance. Those concerned have since accepted and approved the revised standard as shown herein, for promulgation by the United States Department of Commerce, through the National Bureau of Standards.

The revised standard is effective for new production six months after official announcement of cessation of hostilities.

Promulgation recommended.

I. J. Fairchild,

Chief, Division of Trade Standards.

Promulgated.

Lyman J. Briggs,

Director, National Bureau of Standards.

Promulgation approved.

Jesse H. Jones,

Secretary of Commerce.

COMMERCIAL ELECTRIC-REFRIGERATION CONDENSING UNITS

(Second Edition)

COMMERCIAL STANDARD CS107-45

PURPOSE

1. The purpose of this commercial standard is to establish minimum standard specifications and methods of test and rating for commercial electric-refrigeration condensing units (all applications) for the guidance of manufacturers, distributors, installers, contractors, and users.

SCOPE

2. This standard covers minimum requirements, rating, motor loading, and testing of air-cooled and water-cooled, belt-driven commercial electric-refrigeration condensing units, in $\frac{1}{2}$ - to 3-hp sizes, and water-cooled units of 5 hp, using methyl chloride, Freon 12 or SO_2 , refrigerants. This standard covers all applications, including air conditioning. It covers minimum requirements for controls, receiver-tank capacities, and tube sizes for shutoff valves, as well as minimum recommended standard practice for shutoff valves. It also covers a uniform method of guaranteeing compliance with the standard and installation and service pointers. For purposes of field selection, the machines are divided into three groups, as follows:

Group	Ranges of evaporating temperatures (saturated-vapor temperatures corresponding to pressures measured at inlet to the compressor) (5° or smaller steps) as published
(1) Low temperature	Minus 25° F to 0° F.
(2) Medium temperature	0° F to plus 25° F.
(3) High temperature	Plus 25° F to plus 45° F.

DEFINITIONS

3. *Manufacturer.*—A manufacturer, for the purpose of this commercial standard, shall be the company or organization which evidences its responsibility by all of the following:

- (1) Being a prime fabricator of commercial refrigeration machines,
- (2) Qualifying as such by the machining of rough compressor castings, and
- (3) Affixing its name or its distributor's name and/or nationally registered trade-mark or trade name to the compressor or condensing unit.

4. *Capacity.*—The capacity of a commercial electric-refrigeration condensing unit is the refrigerating effect in Btu per hour produced by the change in total heat content between the liquid refrigerant leaving the condensing unit per hour and the total heat content of the vapor refrigerant entering the condensing unit per hour.

5. An *electric-refrigeration condensing unit* is a specific refrigerating machine combination for a given refrigerant, consisting of an electric-motor-driven compressor for operation at a given speed, a condenser,

a liquid receiver, mounted on a suitable frame, and the regularly furnished accessories as listed in paragraph 10, table 1. A self-contained condensing unit is one designed primarily for installation within a machinery compartment or the fixture to be refrigerated. A remote condensing unit is one designed primarily for installation at a point removed from the fixture to be refrigerated.

GENERAL REQUIREMENTS

6. Safety.

6a. The condensing unit shall meet the safety standards of Underwriters' Laboratories, Inc., Standard for Unit Refrigerating Systems, Standard for Air-Conditioning and Commercial Refrigerating Equipment (both Subj. 207), December 1941; Standard for Industrial Control Equipment, July 1938, and subsequent revisions.

6b. Presence on the condensing unit of label or reexamination service marker of Underwriters' Laboratories, Inc., shall be accepted as evidence of compliance with this safety requirement.

7. Radio interference.—The unit shall cause no unreasonable amount of radio interference.

8. Manuals.—The manufacturer shall have available a service and installation manual for his authorized dealers.

DETAIL REQUIREMENTS

9. Condenser cooling medium.—Condensing units one-fifth to 3 hp are either air- or water-cooled. Five-horsepower units are water-cooled only.

10. Standard equipment.—The standard equipment for commercial electric-refrigeration condensing units shall be as shown in table 1.

TABLE 1—Standard equipment as furnished by the manufacturer for commercial electric-refrigeration condensing units, belt-driven

Horsepower	Air-cooled		Water-cooled	
	$\frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}, \frac{3}{4}, 1$	$1\frac{1}{2}, 2, 3$	$\frac{1}{5}, \frac{1}{4}, \frac{1}{3}, 1$	$1\frac{1}{2}, 2, 3, 5$
	2	3	4	5
Compressor with flywheel	Yes	Yes	Yes	Yes
Condenser	Yes	Yes	Yes	Yes
Receiver (may be combined with condenser) except where application does not require receiver	Yes	Yes	Yes	Yes
Motor	Yes	Yes	Yes	Yes
Motor starter (single-phase)	No	Yes	No	Yes
(3-phase)	Yes	Yes	Yes	Yes
Thermal overload protection other than fuses	Yes	Yes	Yes	Yes
High pressure cut-out	No	Yes	Yes	Yes
Refrigerant charge as shipped	lb	5	5	5
Belt guard, remote type only	Yes	Yes	Yes	Yes
Oil charge	Yes	Yes	Yes	Yes
Low-pressure or temperature control, remote type only	Yes	Yes	Yes	Yes
Service valves	Yes	Yes	Yes	Yes
Suction strainer	Yes	Yes	Yes	Yes
Fusible element or relief valve	Yes	Yes	Yes	Yes
Water-regulating valve	Yes	Yes	Yes	Yes
Belt or belts	Yes	Yes	Yes	Yes
Condenser fan	Yes	Yes	Yes	Yes
Base	Yes	Yes	Yes	Yes
Liquid shutoff valve	Yes	Yes	Yes	Yes
Wiring between temperature or pressure control and motor*	Yes	Yes	Yes	Yes
Name plate	Yes	Yes	Yes	Yes

* Across-the-line starters must be supplied where the temperature or pressure control is not capable of starting and stopping the motor directly. Suitable motors and starters for other types of current should be furnished by the manufacturer.

* Where separate motor starter is supplied, wiring between temperature or pressure control and motor is not required to be furnished by the manufacturer.

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11. Condensing units.

11a. Published figures of the temperature-capacity ratings of a given condensing unit shall be in 5-degree or smaller increments and shall include the applicable ASRE standard ratings at groups I, II, III, and IV to cover at least one of the three groups, as follows:

Group	Ranges of evaporating temperatures (saturated-vapor temperatures corresponding to pressures measured at inlet to the compressor)
(1) Low temperature	Minus 25° F to 0° F.
(2) Medium temperature	0° F to plus 25° F.
(3) High temperature	Plus 25° F to plus 45° F.

11b. For rating purposes, the machines shall be rated and tested in accordance with the methods outlined in American Society of Refrigerating Engineers "Standard Methods of Rating and Testing Mechanical Condensing Units, Circular No. 14," using test temperatures of the nearer ASRE group for any evaporating temperature at which the test is made.

11c. Additional ratings at other ambients may be listed if so desired.

12. Motors.

12a. For the purpose of determining maximum motor horsepower, no condensing unit of 5 hp or less shall require more than the horsepower shown in table 2, when tested for performance at rated voltage and at the conditions of test specified in paragraph 12b (5).

12b. Conditions for determining maximum motor load.

- (1) Water-inlet temperature of water-cooled units 75° F.
- (2) Water-outlet temperature of water-cooled units 95° F.
- (3) Suction gas (refrigerant vapor entering the compressor) superheated to 65° F.
- (4) An ambient temperature of 110° F for both self-contained-type and remote-type units, air- and water-cooled.
- (5) Evaporating temperature (saturated-vapor temperature corresponding to pressure measured at inlet to the compressor) in each group shall be as follows:
 - (a) Low temperature, plus 5° F.
 - (b) Medium temperature, plus 30° F.
 - (c) High temperature, plus 50° F.

12c. The manufacturer's maximum motor test loading for each size of unit shall be as shown in table 2.

TABLE 2.—Peak test loading for all single-phase motors and for polyphase motors * 1½ hp and larger

Motor name-plate horse-power rating	Brake horse-power at motor shaft (peak test load, as determined from paragraphs 12a and 12b)	Motor name-plate horse-power rating	Brake horse-power at motor shaft (peak test load, as determined from paragraphs 12a and 12b)	Motor name-plate horse-power rating	Brake horse-power at motor shaft (peak test load, as determined from paragraphs 12a and 12b)
1/16	0.375	3/4	1.17	3	4.5
1/14	.43	1	1.5	5	7.0
1/12	.56	1 1/4	2.25		
1/10	.80	2	3.00		

* Due to their low starting torque, polyphase motors of less than 1½ hp are usually one size larger than shown in table 2 for a given peak test load.

12d. Motors used on commercial electric-refrigeration condensing units shall conform to the standards of the National Electrical Manufacturers Association as given in part on pages 5 and 6.

12e. Other motor requirements shall be in accordance with NEMA Motor Standards.

13. *Controls.*

13a. Each condensing unit shall be equipped with controls, as specified in table 1.

14. *Receiver tanks.*—The minimum volume for receiver tanks shall be as given in table 3.

TABLE 3.—*Minimum receiver-tank volume*

Horsepower	Remote-type	Self-con-	Horsepower	Remote-type	Self-con-
	units	tained-type		units	tained-type
	cu in.	cu in.		cu in.	cu in.
1/4	55	55		325	
1/4	55	55	1/2	450	
1/4	75	75	2	550	
1/2	100	100	3	700	
2	250	5		1,000	

15. *Shutoff valves.*

15a. *Tube size.*—The tube sizes of shutoff valves shall be not less than those shown in table 4.

TABLE 4.—*Minimum required tube sizes, outside diameter, for shutoff valves*

Horse-power	Type of unit	Liquid	Suction	Dis-charge ¹	Receiver ¹	
					Water-cooled	Air-cooled
1/4	Self-contained	1/4	3/8	3/8	1/4	1/4
	(Remote)	1/4	3/8	3/8	1/4	1/4
1/4	Self-contained	1/4	3/8	3/8	1/4	1/4
	(Remote)	1/4	3/8	3/8	1/4	1/4
1/2	Self-contained	1/4	3/8	3/8	1/4	1/4
	(Remote)	1/4	3/8	3/8	1/4	1/4
1/2	Self-contained	1/4	3/8	3/8	1/4	1/4
	(Remote)	1/4	3/8	3/8	1/4	1/4
3/4	Remote	3/8	5/8	1/2	3/8	3/8
	do	3/8	5/8	1/2	3/8	3/8
1 1/2	do	3/8	5/8	1/2	3/8	3/8
2	do	3/8	5/8	1/2	3/8	3/8
3	do	3/8	1 1/8	3/4	3/8	5/8
5	do	3/8	1 1/8	3/4	3/8	5/8

¹ Where 2 valves are furnished, they shall be standard valves of equivalent or greater outlet-tube area than specified.

15b. *Standard practice.*—Minimum recommended standard practice for shutoff valves is shown in tables 5, 6, 7, 8, and 9. Minimum required tube sizes for these valves (see paragraph 15a) are repeated in these tables for convenient reference.

16. NEMA Standards (condensed).

16a. Motors used on commercial electric refrigeration condensing units shall be of the general purpose type and shall comply in every respect with National Electrical Manufacturers Association Motor and Generator Standards (Publication No. 41-64 and superseding issues) as follows:

Small power motors, direct current	MG8-30 to MG8-72, incl.
Small power motors, alternating current	MG8-80 to MG8-132, incl.
Large power motors, direct current	MG9-10 to MG9-115, incl.
Large power motors, single phase	MG9-310 to MG9-414, incl.
Large power motors, polyphase induction	MG9-510 to MG9-619, incl.

16b. The following extracts taken from NEMA Motor and Generator Standards, Publication 41-64, for alternating-current motors are given as an indication of the more pertinent items to be considered in determining whether or not a given motor as applied meets the requirements:

PERFORMANCE STANDARDS

16b. (1) *MG8-100 temperature rise.*—The temperature rise of each of the various parts, above the temperature of the cooling medium, shall not exceed the values given in the following tabulation:

Class of insulation	O	A
Load, percentage of rated capacity	100	100
Time rating		Continuous
Temperature rise:		
1. Coil windings, cores, and mechanical parts in contact with or adjacent to insulation.		
(a) General-purpose motors	40° C	
(b) Totally enclosed and totally enclosed fan-cooled motors	55° C	
(c) Motors and generators other than (a) and (b)	35° C	50° C
2. Commutators and collector rings.		
(a) General-purpose motors	55° C	
(b) Totally enclosed and totally enclosed fan-cooled motors	65° C	
(c) Motors and generators other than (a) and (b)	50° C	65° C
3. Miscellaneous parts (such as brush holders, brushes, pole tips, etc.) other than those whose temperatures affect the temperature of the insulating material may attain such temperatures as will not be injurious in any other respect.		
4. Squirrel-cage windings may attain such temperatures as will not occasion mechanical injury to the machine.		

NOTE I.—No overload temperature guarantee given.

NOTE II.—See MG4-10 for descriptive specification covering class A and class O insulation.

NOTE III.—All temperature measurements by the thermometer method.

NOTE IV.—All temperature rises are based on an ambient temperature of 40° C. General guarantees do not apply and deterioration of insulation may be expected, if this ambient temperature is exceeded in regular operation.

NOTE V.—See MG4-11 for descriptive specification of temperature rating.

NOTE VI.—See MG3-25.

NOTE VII.—The Underwriters' Laboratories, Inc. approves certain motor-driven appliances under a definite duty cycle and under such conditions permits the motor to have a 65° C temperature rise in a 24° C ambient.

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16b. (2) *MG8-101 minimum efficiencies, power factors, and apparent efficiencies.*¹—The efficiency, power factor, and apparent efficiency of the following ratings shall not be less than the values given below at rated voltage, frequency, and load.

¹ The power factor and efficiency must be not less than the values shown and such that their product is not less than the values given for apparent efficiency.

2, 4, 6 and 8-pole, 60-cycle motors, single-phase

(a) General purpose

Rating hp	Efficiency Percent			Power factor Percent			Apparent efficiency Percent		
	Speed, rpm			Speed, rpm			Speed, rpm		
	3,600	1,800	1,200	900	3,600	1,800	1,200	900	
1/2	46	58	48	38	57	52	48	38	28
1/2	49	58	49	42	62	58	50	38	34
1/2	53	61	53	45	66	59	49	40	39
1/2	54	63	54	46	67	61	50	41	41
1/2	58	65	55	47	69	63	52	43	44
1/2	61	67	57	48	72	66	44	46	47

17. Production tests on units.

17a. Each unit shall be manufactured so that—

- (1) Proper alignment between motor and compressor flywheel is obtained.
- (2) All major components are interchangeable with like components on like models.
- (3) Complete condensing unit is dehydrated.
- (4) The motor load shall not exceed the requirements herein.
- (5) The refrigerating capacity of the condensing unit shall conform to the limits of the group for which designed.
- (6) Controls and shutoff valves function properly.

17b. Each assembled unit shall be bench-tested and adjusted for a suitable period of time to reveal and eliminate—

- (1) Oil leaks.
- (2) Refrigerant leaks.
- (3) Electrical defects.
- (4) Excessive mechanical noise and vibration.
- (5) Other defects.

TABLE 5.—Liquid shutoff valves.

Horsepower	Type of unit	Type	Receiver connection ¹	Size ²	Tube connection	Single or back seat	Stem end
1/2	Self-contained ³	Angle or straight (welded, brazed, soldered, or forged)	Male pipe thread, $\frac{1}{4}$ in.	$\frac{1}{8}$	SAE flare, compression	Single	$\frac{1}{8}$ in. sq.
1/2	Remote ³	do	do	$\frac{1}{8}$	do	do	Do.
1/2	Self-contained ³	do	do	$\frac{1}{8}$	do	do	Do.
1/2	Remote ³	do	do	$\frac{1}{8}$	do	do	Do.
1/2	Self-contained ³	do	do	$\frac{1}{8}$	do	do	Do.
1/2	Remote ³	do	do	$\frac{1}{8}$	do	do	Do.
1/2	Remote ³	do	Male pipe thread, $\frac{3}{8}$ in.	$\frac{3}{8}$	do	do	Do.
1/2	do	do	do	$\frac{3}{8}$	do	do	Do.
1/2	do	do	do	$\frac{3}{8}$	SAE flare, compression, or soldered	do	Do.
2	do	do	do	$\frac{1}{2}$	do	do	Do.
3	do	do	do	$\frac{1}{2}$	do	do	Do.
5	do	do	Male pipe thread, $\frac{3}{4}$ in.	$\frac{3}{4}$	do	do	Do.

¹ The manufacturer is at liberty to use standard compressor shutoff valves for liquid shutoff valves where desired.² Receiver connection applies only to pipe-thread valve connection at receiver.³ Or combination liquid receiver-liquid line shutoff valve with $\frac{1}{4}$ -in. or $\frac{3}{8}$ -in. SAE male inlet from condenser to receiver and $\frac{1}{4}$ -in. SAE male liquid outlet line connection— $\frac{1}{4}$ -in. outside diameter dip tube. Dip tube outside diameter same as liquid line outside diameter.

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TABLE 6.—*Suction shutoff valves*

Horsepower	Type of unit	Type	Bolts			Tube size, out-side diameter	Tube connection	Single or back seat	Gage outlet	Stem end
			No. of	in.	Size					
$\frac{1}{6}$	Self-contained	Flange	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	SAE flare, comp- ression, or soldered.	Back	$\frac{1}{8}$ in. female pipe thread	$\frac{1}{4}$ in. sq.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$\frac{1}{4}$	Self-contained	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$\frac{1}{8}$	Self-contained	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$\frac{1}{16}$	Self-contained	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$\frac{3}{4}$	Self-contained	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$1\frac{1}{2}$	do	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	Soldered	do	do	$\frac{1}{8}$ in. sq.
	do	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
2	do	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	$\frac{1}{8}$ in. sq.
	do	do	2	$\frac{1}{16}$	$2\frac{1}{2}$	$1\frac{1}{8}$	do	do	do	$\frac{1}{8}$ in. sq.
3	do	do	2	$\frac{1}{16}$	$2\frac{1}{2}$	$1\frac{1}{8}$	do	do	do	$\frac{1}{8}$ in. sq.
	do	do	4	$\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{8}$	do	do	do	$\frac{1}{8}$ in. sq.

TABLE 7.—*Discharge shutoff valves*¹

Horsepower	Type of unit	Type	Bolts			Tube size, out-side diameter	Tube connection	Single or back seat	Gage outlet	Stem end
			No. of	in.	Size					
$\frac{1}{6}$	Self-contained	Flange	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	SAE flare, comp- ression, or soldered.	Back	$\frac{1}{8}$ in. female pipe thread	$\frac{1}{4}$ in. sq.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$\frac{1}{4}$	Self-contained	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$\frac{1}{8}$	Self-contained	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$\frac{1}{16}$	Self-contained	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$\frac{3}{4}$	Self-contained	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	Remote	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
$1\frac{1}{2}$	do	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	do	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	Soldered	do	do	$\frac{1}{8}$ in. sq.
2	do	do	2	$\frac{1}{16}$	$1\frac{1}{8}$	$\frac{3}{8}$	do	do	do	Do.
	do	do	2	$\frac{1}{16}$	$2\frac{1}{2}$	$\frac{3}{8}$	do	do	do	$\frac{1}{8}$ in. sq.
3	do	do	2	$\frac{1}{16}$	$2\frac{1}{2}$	$\frac{3}{8}$	do	do	do	$\frac{1}{8}$ in. sq.
	do	do	2	$\frac{1}{2}$	$2\frac{1}{2}$	$\frac{3}{8}$	do	do	do	$\frac{1}{8}$ in. sq.

¹ Where two discharge valves are furnished, they shall be standard valves having equivalent or greater outlet-tube area than specified.

*Commercial Standard OS107-45*TABLE 8.—*Receiver shutoff valves¹*

[Water-cooled condensing units]

Horsepower	Type of unit	Type	Receiver connection ²	Tube size, outside diameter ³	Tube connection	Single or back seat	Stem end
$\frac{1}{4}$	Remote	Angle (welded, brazed, soldered, or forged)	Weld or $\frac{3}{8}$ in. MPT ⁴	$\frac{1}{4}$ in.	SAE flare or compression	Single	$\frac{1}{4}$ in. sq.
$\frac{1}{2}$	do	do	do	$\frac{1}{2}$	do	do	Do.
$\frac{3}{4}$	do	do	do	$\frac{1}{2}$	do	do	Do.
1	do	do	$\frac{1}{2}$ in. MPT ⁴	$\frac{5}{8}$	SAE flare, compression, or soldered	do	Do.
$1\frac{1}{2}$	do	do	do	$\frac{5}{8}$	do	do	Do.
2	do	do	$\frac{3}{4}$ in. MPT ⁴	$\frac{3}{4}$	Soldered	do	$\frac{3}{8}$ in. sq.
3	do	do	do	$\frac{3}{4}$	do	do	Do.
5	do	Flange	($\frac{3}{4}$ -in. bolt center) ($\frac{2}{3}$ -in. bolt center)	$\frac{7}{8}$	do	Back	$\frac{3}{8}$ in. sq.

¹ The manufacturer is at liberty to use standard compressor shutoff valves for receiver shutoff valves where desired. If two receiver valves are furnished, they shall be standard valves of equivalent or greater outlet-tube area than specified.

² Receiver connection applies only to pipe-thread valve connection.

³ Male pipe thread.

TABLE 9.—*Receiver shutoff valves¹*

[Air-cooled condensing units]

Horsepower	Type of unit	Type	Receiver connection ²	Tube size, outside diameter ³	Tube connection	Single or back seat	Stem end
$\frac{1}{4}$	Self-contained ¹	Angle (welded, brazed, soldered, or forged)	$\frac{1}{4}$ -in. male pipe thread	$\frac{1}{4}$	SAE flare or compression	Single	$\frac{1}{4}$ in. sq.
$\frac{1}{2}$	Remote ¹	do	do	$\frac{1}{4}$	do	do	Do.
$\frac{3}{4}$	Self-contained ¹	do	do	$\frac{1}{4}$	do	do	Do.
$\frac{3}{4}$	Remote ¹	do	do	$\frac{1}{4}$	do	do	Do.
$\frac{3}{4}$	Self-contained ¹	do	do	$\frac{1}{4}$	do	do	Do.
$\frac{1}{2}$	Self-contained ¹	do	do	$\frac{1}{4}$	do	do	Do.
$\frac{3}{4}$	Remote ¹	do	$\frac{1}{4}$ -in. male pipe thread	$\frac{1}{4}$	do	do	Do.
1	do	do	do	$\frac{3}{8}$	do	do	Do.
$1\frac{1}{2}$	do	do	do	$\frac{3}{8}$	do	do	Do.
2	do	do	do	$\frac{1}{2}$	do	do	Do.
3	do	do	$\frac{1}{2}$ -in. male pipe thread	$\frac{5}{8}$	SAE flare, compression, or soldered	do	Do.

¹ The manufacturer is at liberty to use standard compressor shutoff valves for receiver shutoff valves where desired. If two receiver valves are furnished, they shall be standard valves of equivalent or greater outlet-tube area than specified.

² When a combination liquid receiver-liquid line shutoff valve is used as shown in footnote 3 of table 5 or a standard liquid line shutoff valve is used, this receiver shutoff valve is not required.

LABELING

18. The name of the manufacturer or distributor, model number, refrigerant used, and serial number shall be shown in a conspicuous place on each unit.

19. *Warranty.*—The condensing unit shall be warranted by the condensing unit manufacturer against defects of material and workmanship for a period of 90 days from date of installation.

20. *Guarantee of compliance.*—In order that purchasers of condensing units may be assured that these units comply with the requirements of this standard as a basis for fair competition, it is recommended that the following statement be included in manufacturers' and/or distributors' warranties, labels, invoices, contracts, sales literature, etc.:

This refrigeration condensing unit complies with all requirements of Commercial Standard CS107-45, as issued by the National Bureau of Standards, of the United States Department of Commerce.

INSTALLATION AND SERVICE INSTRUCTIONS

21. It is recommended that a copy of the following "Installation and Service Instructions" be furnished with each refrigeration condensing unit, and included in each installation and service manual.

Be sure to study these important pointers.

IMPORTANT.—This unit is constructed of high-grade materials, built by modern precision methods, every part carefully gaged and inspected, and the entire unit tested. When it left the factory, it was free of foreign matter and thoroughly dehydrated. Careless or thoughtless installation methods may nullify all the care, expense, and planning that went into the building of this unit. A careful and efficient installation will enable it to give the years of satisfactory use for which it was designed. **IT IS NOW UP TO YOU, THE INSTALLER.**

<i>Check List</i>	<i>Instructions</i>
Location-----	Place condensing unit where it has a free circulation of air. If a water-cooled unit do not install where it will be subjected to freezing temperatures.
Motor lubrication-----	Lubricate motor bearings before starting this unit. Use only lubricant of the grade recommended by the motor manufacturer.
Electrical specifications-----	Check name plate on motor and controls to be certain that motor is being connected to circuit supplying the correct current.
Line protection-----	Use line fuses of proper rating. (See National Electrical Safety Code.)
Pulley alinement-----	Make certain that pulleys are in alinement and that belt is adjusted to proper tension.
Compressor rotation-----	Check direction of rotation of compressor as indicated by arrow on unit.
Cleaning evaporator lines-----	Be sure evaporator and lines are dry and clean. If they have stood open, blow out and dry.
Strainer-----	The use of a liquid line strainer for protection of the system is recommended.
Drying evaporator lines-----	Use only suction or liquid line dryers to remove moisture. Use dryers which have been recommended by the condensing unit manufacturer.

*Check List**Instructions*

- Remove moisture-laden air. Draw a deep no-bubble vacuum on the low side of the refrigeration system before charging with refrigerant, using a vacuum pump designed for that purpose.
- Compressor lubrication. Check the compressor oil level after condensing unit has operated a few hours, and add oil as required to make up for that in the lines and evaporator. Use only clean, dry oil in sealed containers approved by the manufacturer of this condensing unit.
- Leak test. Test all joints carefully for leaks. Make certain that the entire system is gas tight.
- Expansion-valve adjustment. Check adjustment of expansion valve and reset if necessary to keep liquid refrigerant from returning to the compressor. Be sure to use the proper size valve.
- Refrigerant requirements. Use only refrigerant specified on unit name plate, that is clean and dry.
- Installation recheck. Before leaving the installation as complete, recheck temperature, valve settings, and general operation, always using gages. See that service-valve caps, control covers, and other loose parts are in place. Also recheck pressures, compressor oil level, and the motor oil.
- User instructions. Instruct the customer or user in the care and operation of this unit—how to oil motor, and replace fuses or reset overload. Leave your name, address, and telephone numbers, day and night, posted near the unit.

EFFECTIVE DATE

22. The standard is effective for new production 6 months after official announcement of cessation of hostilities.

STANDING COMMITTEE

23. The following individuals comprise the membership of the standing committee, which is to review, prior to circulation for acceptance, revisions proposed to keep the standard abreast of progress. Each organization nominated its own representative. Comment concerning the standard and suggestions for revision may be addressed to any member of the committee or to the Division of Trade Standards, National Bureau of Standards, which acts as secretary for the committee.

Manufacturers:

C. P. SPALDING (chairman), General Refrigeration Division, Yates-American Machine Co., Beloit, Wis.
FRANK H. FAUST, Air Conditioning and Commercial Refrigeration Divisions, General Electric Co., 5 Lawrence St., Bloomfield, N. J.
C. E. PLOEGER, Electric Refrigeration and Air Conditioning Division, Servel Inc., Evansville, Ind.
E. K. SMITH, Tecumseh Products Co., Tecumseh, Mich.
A. E. CADWELL, Universal Cooler Corporation, Marion, Ohio.
STERLING F. SMITH, Mills Industries, Inc., 4100 Fullerton Ave., Chicago 39, Ill.

Distributors and Installers:

ALEX H. HOLCOMBE, JR., Victor Sales & Supply Co., 2222 Arch St., Philadelphia, Pa.
H. S. McCLOUD, Williams & Co., Inc., 901 Penna. Ave., N. W., Pittsburgh 12, Pa.
GEOFFREY J. ROCHE, Parks & Hull Appliance Corporation, 1029 Cathedral St., Baltimore 1, Md.
(Above 3 representing National Refrigeration Supply Jobbers Association.)
ERNEST GYGAX, 5446 Claxton St., St. Louis, Mo.
H. D. BUSBY, 2432 Hessing St., River Grove, Ill.
F. C. STRONG, 83 Humbervale Blvd., Toronto 9, Ontario, Canada.
(Above 3 representing Refrigeration Service Engineers Society.)

Users:

GEORGE K. BENTLY, McCray Refrigerator Co., Kendallville, Ind. (Representing Commercial Refrigerator Manufacturers Association.)
HENRY F. HOERSCHELMANN, H. C. Bohack Co., Metropolitan & Flushing Ave., Brooklyn, N. Y. (Representing National Association of Food Chains.)
J. H. BROADBENT, Rockefeller Center, Inc., 50 Rockefeller Plaza, New York 20, N. Y. (Representing National Association of Purchasing Agents.)
JOHN A. KOTAI, The National Association of Retail Meat Dealers, Inc., Suite 1900, 176 W. Adams St., Chicago, Ill.

Laboratories and General Interests:

GLENN MUFFLY, 132 S. Kensington Place, Springfield, Ohio.
R. S. DILL, National Bureau of Standards, Washington 25, D. C.
S. V. JAMES, Underwriters' Laboratories, Inc., 207 East Ohio St., Chicago 11, Ill.

HISTORY OF PROJECT

24. The Standard Refrigeration Compressor Association on August 9, 1941, requested the cooperation of the National Bureau of Standards in the establishment of a commercial standard for belt-driven, commercial electric-refrigeration condensing units. Several committees had previously drafted independent elements of the proposed standard, and, after suitable adjustments, four subcommittee reports were transmitted on April 15, 1942, to the National Bureau of Standards.

25. These reports formed the basis for a proposed commercial standard, which was circulated on May 30, 1942, to all manufacturers of record, interested Government agencies, and others, with an invitation to a conference. On June 23, 1942, a conference of interested manufacturers and Government agencies adjusted and adopted a revised draft, which was circulated broadly on July 8, 1942, to installers, users, distributors, manufacturers, and trade periodicals for comment.

26. Following suitable adjustment in line with the composite written comment, the revised draft was circulated on October 21, 1942, to the entire trade for written acceptance, as it appeared that there was substantial approval of the draft; and, for this reason, coupled with wartime emergency conditions, further conferences seemed unnecessary. Upon receipt of acceptances in writing from a preponderant majority, announcement was issued on February 15, 1943, that the standard would become effective for new production from May 15, 1943, under the identification CS(E)107-43.

FIRST REVISION

27. On June 24, 1943, the Standard Refrigeration Compressor Association proposed a number of revisions to bring the standard more completely in line with current practice as a result of experience. These revisions were referred, on July 19, 1943, to the standing committee, which approved them. On November 6, 1943, additional changes to cover hermetic type condensing units were submitted to the standing committee, but these changes were subsequently withdrawn.

28. On June 23, 1944, following further adjustments and approval by the standing committee, the recommended revision was circulated to the entire trade for written acceptance, with the result that the revision was accepted by a satisfactory majority, and the establishment of the revision was announced on December 30, 1944, as Commercial Standard CS107-45.

CS107-45

ACCEPTANCE OF COMMERCIAL STANDARD

If acceptance has not previously been filed, this sheet properly filled in, signed, and returned will provide for the recording of your organization as an acceptor of this commercial standard.

Date _____

Division of Trade Standards,
National Bureau of Standards,
Washington 25, D. C.

Gentlemen:

Having considered the statements on the reverse side of this sheet, we accept the Commercial Standard CS107-45 as our standard of practice in the

Production¹ Distribution¹ Use¹ Testing¹
of commercial electric-refrigeration condensing units.

We will assist in securing its general recognition and use, and will cooperate with the standing committee to effect revisions of the standard when necessary.

(Cut on this line)

Signature of individual officer _____
(In ink)

(Kindly typewrite or print the following lines)

Name and title of above officer _____

Organization _____
(Fill in exactly as it should be listed)

Street address _____

City, zone, and State _____

¹ Please designate which group you represent by drawing lines through the other three. Please file separate acceptances for all subsidiary companies and affiliates which should be listed separately as acceptors. In the case of related interests, trade papers, colleges, etc., desiring to record their general approval, the words "in principle" should be added after the signature.

COMMERCIAL STANDARDS TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance.

1. *Enforcement.*—Commercial standards are commodity specifications voluntarily established by mutual consent of those concerned. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The United States Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the interested groups as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices and the like.

2. *The acceptor's responsibility.*—The purpose of commercial standards is to establish for specific commodities, nationally recognized grades or consumer criteria and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the commercial standard where practicable, in the production, distribution, or consumption of the article in question.

3. *The Department's responsibility.*—The major function performed by the Department of Commerce in the voluntary establishment of commercial standards on a Nation-wide basis is fourfold: first, to act as an unbiased coordinator to bring all interested parties together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors, and users; and fourth, after acceptance, to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. *Announcement and promulgation.*—When the standard has been endorsed by a satisfactory majority of production or consumption in the absence of active, valid opposition, the success of the project is announced. If, however, in the opinion of the standing committee or the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

ACCEPTORS

29. The organizations and individuals listed below have accepted this commercial standard as their standard of practice in the production, distribution, and use of commercial electric refrigeration condensing units. Such endorsement does not signify that they may not find it necessary to deviate from the standard nor that producers so listed guarantee all of their products in this field to conform with the requirements of this standard. Therefore, specific evidence of conformity should be obtained where required.

ASSOCIATIONS

American Association of Engineers, Chicago, Ill.
 Dairymen's League Co-operative Association, Inc., New York, N. Y.
 Franklin Co-operative Creamery Association, Minneapolis, Minn.
 Heating, Piping & Air Conditioning Contractors National Association, New York, N. Y.
 National Association of Retail Meat Dealers, Inc., The, Chicago, Ill.
 Refrigeration Service Engineers Society, Toledo, Ohio.
 Refrigeration Service Engineers Society, Boston Chapter #1, Dedham, Mass.
 Refrigeration Service Engineers Society, Hudson Mohawk Chapter, Schenectady, N. Y.
 Refrigeration Service Engineers Society, Kansas City Chapter, Kansas City, Mo.
 Refrigeration Service Engineers Society, Madison Chapter, Madison, Wis.
 Refrigeration Service Engineers Society, Pony Express Chapter, St. Joseph, Mo.
 Refrigeration Service Engineers Society, St. Louis Chapter, St. Louis, Mo.
 Refrigeration Service Engineers Society, Wyoming Valley Chapter, Wyoming, Pa.
 Standard Refrigeration Compressor Association, Pittsburgh, Pa.

FIRMS

A-1 Refrigeration Co., Milwaukee, Wis.
 Acme Breweries, San Francisco, Calif.
 Air Conditioning & Refrigeration Supplies, Inc., Charleston, W. Va.
 Aird-Don Co., Albany, N. Y.
 Alabama University of, University, Ala.
 All-Types Refrigeration Service, Chicago, Ill.
 Allen & Co., J. W., Chicago, Ill.
 Alter Co., The Harry, Chicago, Ill.
 American Airlines, Inc., Jackson Heights, N. Y.
 American Packing & Provision Co., Ogden, Utah.
 Appliance Engineering Corporation, Boston, Mass.
 Atherton Co., F. A., Worcester, Mass.
 Atlas Electric Devices Co., Chicago, Ill.
 Bader Supply Co., Tulsa, Okla.
 Baker Ice Machine Co., Inc., Omaha, Nebr.
 Ballantine & Sons, Inc., Newark, N. J.
 Baltimore & Ohio Railroad Co., The, Baltimore, Md.
 Bastian-Blessing Co., The, Chicago, Ill.
 Baxter Co., Duluth, Minn.
 Beech-Nut Packing Co., Canajoharie, N. Y.
 Berks Engineering Co., Reading, Pa.
 Berner-Pease, Miami, Fla.
 Better Living Co., Jackson, Miss.
 Birkenwald Co., S., Portland, Oreg.
 Blueprint Co., Inc., W. Sayville, N. Y.
 Bohack Co., Inc., H. C., Brooklyn, N. Y.
 Bowers Wholesale Corporation, Norfolk, Va.
 Brass & Copper Sales Co., St. Louis, Mo.
 Brown Electric Co., Columbus, Ga.
 Brown, Rogers, Dixon, Winston-Salem, N. C.
 Brunner Manufacturing Co., Utica, N. Y.
 Buckeye Brewing Co., The, Toledo, Ohio.
 Burk, Inc., Louis, Philadelphia, Pa.
 Bush Manufacturing Co., Elmwood, Conn.
 California Refrigerator Co., San Francisco, Calif.
 California, University of, College of Engineering, Berkeley, Calif.
 Campbell Heating Co., E. K., Kansas City, Mo.
 Carrier Corporation, Syracuse, N. Y.

Case & Son Manufacturing Co., W. A., Binghamton, N. Y., and Erie, Pa.
 Centilivre Brewing Corporation, Fort Wayne, Ind.
 Central Inspection Bureau, Portland, Ore.
 Chemurgo Research Laboratory, Dallas, Tex. (In principle.)
 Chrysler Corporation, Airtemp Division, Dayton, Ohio.
 Commercial Refrigeration Sales, Flint, Mich.
 Commercial Refrigeration Service Co., Brooklyn, N. Y.
 Commercial Sales Co., Washington, D. C.
 Connecticut Electric Equipment Co., Inc., The, Meriden, Conn.
 Continental Refrigeration Service, Chicago, Ill.
 Curtis Refrigerating Machine Division, St. Louis, Mo.
 Crump Co., Inc., B. T., Richmond, Va.
 Dayton, University of, Dayton, Ohio.
 De Laval Sales & Service, Inc., Poughkeepsie, N. Y.
 Deissler Machine Co., Gasport, N. Y.
 Detroit Testing Laboratory, The, Detroit, Mich.
 Detroit, University of, Detroit, Mich.
 Detwiler Refrigeration Service Co., St. Louis, Mo.
 Dick & Co., Inc., Henry V., Charlotte, N. C.
 Dunville Bros., Robert M., Richmond, Va.
 Duquesne Brewing Co. of Pittsburgh, Pittsburgh, Pa.
 Durf Packing Co., Inc., G. A., Utica, N. Y.
 Eastern Air Lines, Inc., Miami, Fla.
 Eastern Refrigeration & Air Conditioning Co., Richmond, Va.
 Ekroth Laboratories, Inc., Brooklyn, N. Y.
 El Paso Testing Laboratories, El Paso, Tex.
 Electric Products, Inc., Jersey City, N. J.
 Electrical Testing Laboratories, Inc., New York, N. Y.
 Electrified Appliances Co., Newark, N. J.
 Emmett Ice Co., Inc., The, Emmett, Idaho.
 Equitable Equipment Co., Inc., New Orleans, La.
 Ever-Ready Refrigeration Co., Trenton, N. J.
 Federal Store Equipment, Inc., Milwaukee, Wis.
 Fleck Bros., Ltd., Vancouver, B. C., Canada.
 Froehling & Robertson, Inc., Richmond, Va. (In principle.)
 George's Services, Jacksonville, N. C.
 Georgia School of Technology, Atlanta, Ga.
 Goetz Brewing Co., M. K., St. Joseph, Mo.
 Gorton-Hew Fisheries Co., Ltd., Gloucester, Mass.
 Hallmark Laboratories, The, Jamestown, N. Y.
 Hanks, Inc., Abbot A., San Francisco, Calif.
 Hansen, Perry G., Akron, Ohio.
 Harris & Son, B. F., Grand Rapids, Mich.
 Hauser Refrigerating & Equipment Co., Inc., Rochester, N. Y.
 Hawley Electric Co., Inc., Syracuse, N. Y.
 Hayes Brothers, Inc., Indianapolis, Ind.
 Herrel & Sons Co., J., Columbus, Ohio.
 Herron Co., The James H., Cleveland, Ohio.
 Hinshaw Supply Co., Sacramento, Calif.
 Hires Co., The Chas. E., Philadelphia, Pa.
 Hoffman Supply Co., Springfield, Mo.
 Hospital Bureau of Standards & Supplies, Inc., New York, N. Y.
 Howe Ice Machine Co., Chicago, Ill.
 Hunter Packing Co., East St. Louis, Ill.
 Idaho, University of, Moscow, Idaho.
 Interstate Machinery & Supply Co., Omaha, Nebr.
 J. & J. Refrigerating Co., Chicago, Ill.
 Jackson Brewing Co., New Orleans, La.
 Jordan Marsh Co., Cambridge, Mass.